



Comparative Perioperative and 5-Year Outcomes of Robotic Inguinal Hernia Repair: A Study of 153,727 Patients in the State of New York

Talar Tatarian MD¹, Lizhou Nie MS², Connor McPartland BS¹, Andrew M Brown MD³, Jie Yang PhD⁴, Maria Altieri MD MS⁵, Konstantinos SpaniolasMD³, Salvatore Docimo DO³, Aurora D Pryor MD MBA³

¹Department of Surgery, Thomas Jefferson University, Philadelphia, Pennsylvania, ²Department of Applied Mathematics and Statistics, Stony Brook University, Stony Brook, New York, ³Department of Surgery, Stony Brook Medicine, Stony Brook, New York, ⁴Department of Family, Population and Preventive Medicine, Stony Brook University, Stony Brook, New York, ⁵Department of Surgery, East Carolina University Brody School of Medicine, Greenville, North Carolina

Objective

To examine the perioperative outcomes of robotic inguinal hernia repair as compared to the open and laparoscopic approaches, utilizing large scale population level data.

Methods and Procedures

The New York Statewide Planning and Research Cooperative System (SPARCS) administrative database was queried to identify all adult patients undergoing initial open (O-IHR), laparoscopic (L-IHR), and robotic (R-IHR) inguinal (direct/indirect/femoral) hernia repair from 2010-2016. Perioperative outcome measures (complications, length of stay [LOS], 30-d emergency department [ED] visits, 30-d readmissions) and estimated 1/3/5-year recurrence rates were compared. Propensity score (PS) analysis was used to estimate marginal differences between R-IHR and L-IHR or O-IHR, using a 1:1 matching algorithm.

Results

- During the study period, a total of 153,727 patients underwent inguinal hernia repair (117,603 [76.5%] O-IHR, 35,565 [23.1%] L-IHR; 559 [0.36%] R-IHR)

Table 1. Patient Demographics and Clinical Information by Surgery Type.

	Total (n=153,727)	Laparoscopic (n=35,565)	Open (n=117,603)	Robotic (n=559)	p-value
Age	57.14±16.45	53.44±15.15	58.24±16.68	61.15±11.55	<0.0001
Age Group					
19-45	36,499 (23.8%)	10,372 (29.2%)	26,080 (22.2%)	47 (8.4%)	<0.0001
46-60	49,204 (32%)	12,978 (36.5%)	36,046 (30.6%)	180 (32.2%)	
≥61	68,024 (44.2%)	12,215 (34.3%)	55,477 (47.2%)	332 (59.4%)	
Sex					
F	17,209 (11.2%)	2,533 (7.1%)	14,621 (12.4%)	55 (9.8%)	<0.0001
M	136,518 (88.8%)	33,032 (92.9%)	102,982 (87.6%)	504 (90.2%)	
Patient Type					
Inpatient	16,065 (10.5%)	1,844 (5.2%)	13,802 (11.7%)	419 (75%)	<0.0001
Outpatient	137,662 (89.5%)	33,721 (94.8%)	103,801 (88.3%)	140 (25%)	
Year					
2010	23,400 (100%)	4,322 (18.5%)	19,016 (81.3%)	62 (0.3%)	<0.0001
2011	23,290 (100%)	4,448 (19.1%)	18,768 (80.6%)	74 (0.3%)	
2012	22,694 (100%)	4,766 (21%)	17,852 (78.7%)	76 (0.3%)	
2013	22,592 (100%)	5,229 (23.1%)	17,283 (76.5%)	80 (0.4%)	
2014	20,814 (100%)	5,328 (25.6%)	15,400 (74%)	86 (0.4%)	
2015	20,596 (100%)	5,690 (27.6%)	14,825 (72%)	81 (0.4%)	
2016	20,341 (100%)	5,782 (28.4%)	14,459 (71.1%)	100 (0.5%)	
Comorbidity	66,886 (43.5%)	13,501 (38%)	53,020 (45.1%)	365 (65.3%)	<0.0001

- On univariate analysis (Table 2), patients with R-IHR had higher rates of any complication, 30-day readmission, 30-day ED visits, and longer length of stay.
- Complications were mostly cardiopulmonary in nature. There were no cases of wound related complications with R-IHR.
- While this study was not designed to specifically compare L-IHR with O-IHR, there was a remarkably lower risk of complications and recurrence with L-IHR

Table 2. Unadjusted Clinical Outcome Comparison by Surgery Type.

Outcome	Total (n=153,727)	Laparoscopic (n=35,565)	Open (n=117,603)	Robotic (n=559)	p-value
Any Complication	4,686 (3.1%)	373 (1.1%)	4,261 (3.6%)	52 (9.3%)	<0.0001
Abscess	37 (0.02%)	4 (0.01%)	33 (0.03%)	0 (0%)	0.2
Cardiac Arrest	53 (0.05%)	5 (0.01%)	48 (0.04%)	0 (0%)	0.0557
Cardiac Complication	309 (0.20%)	28 (0.08%)	276 (0.23%)	5 (0.89%)	<0.0001
Dehiscence	13 (0.01%)	2 (0.01%)	11 (0.01%)	0 (0%)	0.58
Hemorrhage	151 (0.1%)	6 (0.02%)	144 (0.12%)	1 (0.18%)	<0.0001
MI	9 (0.01%)	2 (0.01%)	7 (0.01%)	0 (0%)	1
Pneumonia	756 (0.49%)	33 (0.09%)	718 (0.6%)	5 (0.89%)	<0.0001
Pulmonary Edema	56 (0.04%)	6 (0.02%)	50 (0.04%)	0 (0%)	0.0593
Pulmonary Embolism	50 (0.03%)	1 (<0.01%)	47 (0.04%)	2 (0.36%)	0.0010
Renal Failure	1120 (0.73%)	62 (0.17%)	1,050 (0.89%)	8 (1.43%)	<0.0001
Reoperative Hemorrhage	90 (0.06%)	3 (0.01%)	87 (0.07%)	0 (0%)	0.0031
Respiratory Arrest	2 (<0.01%)	0 (0%)	2 (<0.01%)	0 (0%)	1
Respiratory Failure	866 (0.56%)	47 (0.13%)	815 (0.69%)	4 (0.72%)	<0.0001
Shock	367 (0.24%)	18 (0.05%)	348 (0.30%)	1 (0.18%)	<0.0001
Tracheostomy	60 (0.04%)	5 (0.01%)	55 (0.05%)	0 (0%)	0.0331
Ventilation	220 (0.14%)	8 (0.02%)	212 (0.18%)	0 (0%)	<0.0001
30-d Readmission	3,201 (2.1%)	412 (1.2%)	2,758 (2.4%)	31 (5.5%)	<0.0001
30-d ED Visit	8,972 (5.8%)	1,730 (4.9%)	7,177 (6.1%)	65 (11.6%)	<0.0001
Length of Stay	0.55±3.27	0.19±1.29	0.66±3.66	1.74±2.47	<0.0001

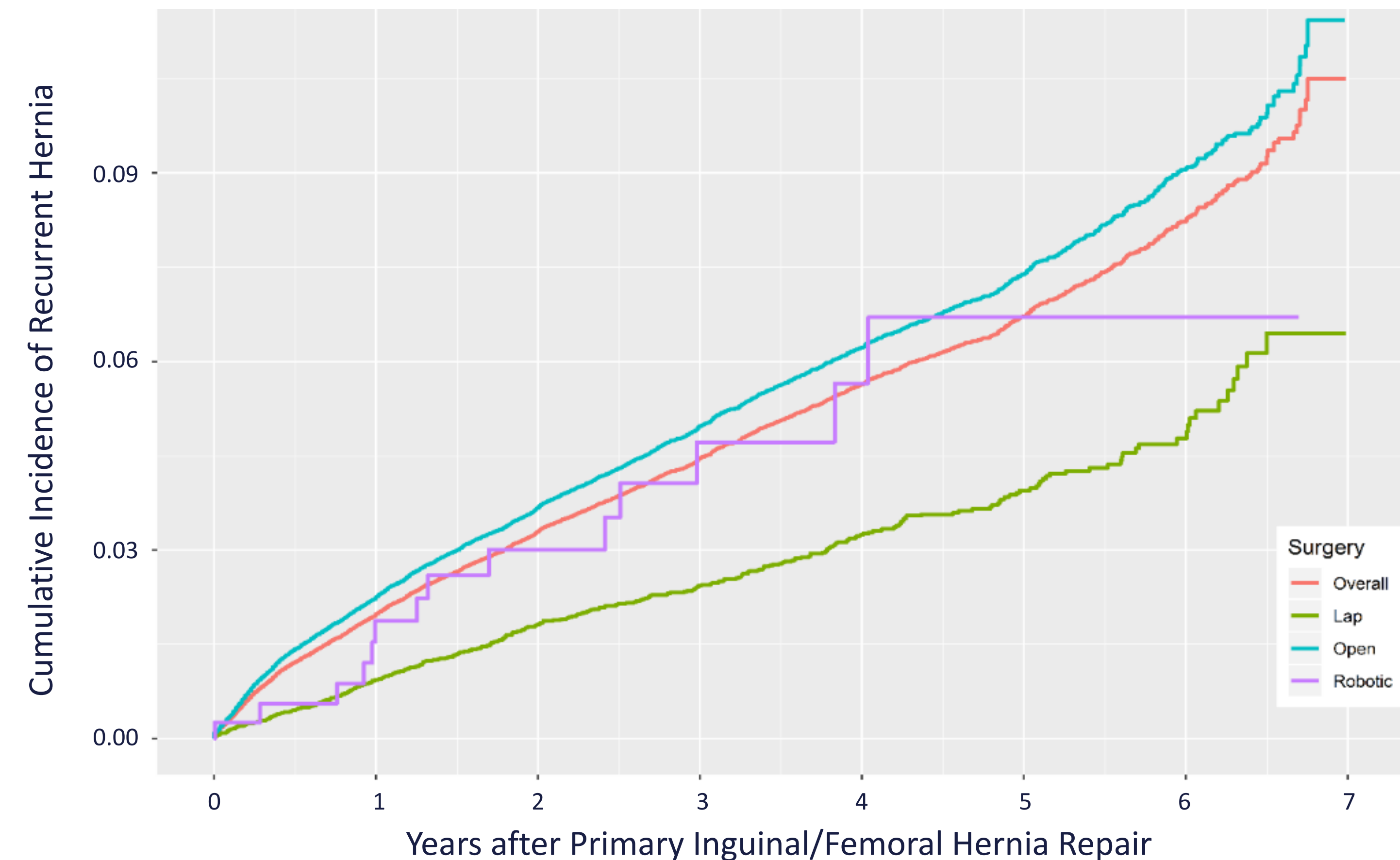
- The unadjusted estimated cumulative incidence of recurrence was greatest after open and lowest after laparoscopic inguinal hernia repair. The overall incidence of recurrence was 6.7% at 5 years. (Table 3, Figure 1)

Table 3. Unadjusted Estimated Cumulative Incidence of Recurrent Hernia at 1, 3, and 5 Years after Initial Hernia Repair.

Surgery	Year 1	Year 3	Year 5
Overall	2.0% (1.9%-2.1%)	4.5% (4.3%-4.6%)	6.7% (6.5%-7.0%)
Laparoscopic	0.9% (0.8%-1.1%)	2.4% (2.2%-2.7%)	4.0% (3.5%-4.4%)
Open	2.3% (2.1%-2.4%)	5.0% (4.8%-5.2%)	7.4% (7.1%-7.7%)
Robotic	1.9% (0.8%-3.9%)	4.7% (2.5%-8.0%)	6.7% (3.6%-11.2%)

- PS analysis found 346 matched pairs of R-IHR and L-IHR and 459 matched pairs of R-IHR and O-IHR.
- There were no differences in perioperative outcomes between R-IHR and L-IHR. The difference in recurrence was found to be sensitive to possible unobserved confounding factors.
- Compared to the O-IHR, R-IHR had significantly lower risk of any complications (OR -0.0915, 95% CI -0.1273, -0.0557, p<0.0001) and shorter LOS (OR 0.53, 95% CI 0.45, 0.62, p<0.0001). These differences persisted even after adjusting for potential unmeasured confounding variables. There was no significant difference in time to recurrent hernia.

Figure 1. Unadjusted Cumulative Incidence Curve of Recurrent Hernia by Surgery Type



Conclusions

In the immediate perioperative period, robotic and laparoscopic inguinal hernia repair may be associated with comparable outcomes, whereas robotic and laparoscopic repair have more favorable outcomes over the open approach. Further randomized studies are needed to assess the clinical variables contributing to these outcomes.

Acknowledgements

This study was funded by the SAGES Robotic Surgery Research Grant (2019).